Summary and Conclusions

Photo: John Cooper

Section 12: Summary and Conclusions

The Lake Erie LaMP process was altered in July 1999 by a resolution passed by the Binational Executive Committee (BEC). In order to accelerate the LaMP process and move from planning and document review to implementation, the four-stage process outlined in the GLWQA was collapsed into a single stage that would concurrently address problem definition, selection of remedial and regulatory measures, and implementation. Reports would be prepared biennially to provide updates on the current status and research needs of the lake and actions underway to restore beneficial uses. This revised approach would allow for more flexibility in the process and the ability to focus more readily on the most pertinent issues for the lake.

This first biennial report for the Lake Erie LaMP focuses primarily on problem definition, identification of data gaps and the remedial actions that we can implement now. The history of the issues of concern in Lake Erie over time is presented, primarily to highlight that Lake Erie is constantly changing as human uses of the land and water in the watershed change. The overview section describes where the lake has been and what is happening now. The physical characteristics of Lake Erie that make it unique and are important to how the whole lake system functions are presented. The overall message is that Lake Erie is continually changing and must have a monitoring and surveillance program that can adapt to adequately assessing ongoing and emerging issues.

The Lake Erie LaMP is being developed by 20 federal and state government agencies along with the Lake Erie Binational Public Forum, a group of Lake Erie basin citizens actively interested in improving the lake. All comments and opinions of the Lake Erie Binational Public Forum are considered when LaMP documents and decisions are produced. In addition to assisting in preparing and reviewing LaMP technical documents, the Lake Erie Binational Public Forum has an agenda to address further public outreach and education. They have adopted the promotion of environmental justice, land stewardship and pollution prevention as concepts to be considered throughout the LaMP process, in both assessment and implementation. The Public Involvement Subcommittee of the LaMP works directly with the Forum to ensure public information and involvement needs are incorporated into the overall LaMP work plan.

Ecosystem objectives for the lake are currently under development. The first step is to select an ecosystem alternative or scenario that is scientifically supportable as well as socially and economically acceptable. Ecosystem alternatives are generally described as various levels and combinations of reduced loadings, land use and preservation of natural areas. They are ***qualitative*** descriptive statements of desired future conditions for the lake. Future management direction for the lake will revolve around whatever alternative is selected. The ecosystem objectives selected will be the more specific end-points that future actions must achieve. Ecosystem indicators will be developed to measure the success of the management actions in achieving the ecosystem objectives. The ecosystem alternative selected for Lake Erie cannot be a return toward the pristine pre-settlement conditions of the 1700s, as the level of change in the ecosystem has been extensive, and in many cases appears irreversible.

Availability of natural undisturbed land is the single most important *condition* affecting the restoration of Lake Erie. Nutrient loading and land use practices are the primary human *activities* (management actions) affecting the future state of the lake. The Lake Erie LaMP developed a model including many ecosystem components of the lake that were grouped into the major categories of management levers, ecosystem health, and beneficial use to humans. The model allows movement of the management levers in different directions and monitors the response to ecosystem health and beneficial use. From this modeling exercise, seven distinct ecosystem alternatives emerged. Three of these alternatives represented conditions that were more highly degraded than the existing environment and were dropped from any further consideration. The four remaining alternatives, one of which represents the status quo, were described in general terms. These alternatives will be presented to the

public in a series of workshops to evaluate which one will be most accepted and supported by public actions. This exercise will also result in further defining specific ecosystem objectives. The LaMP Management Committee will take into account the results of the workshops, reviews by LaMP agencies, the Work Group and the Binational Public Forum to decide on the preferred ecosystem alternative for Lake Erie.

Beneficial use impairment assessments have been completed for all but two of the 14 GLWQA listed beneficial use impairments. Draft impairment conclusions are presented for the two uncompleted BUIAs: benthos and wildlife populations and habitat. The impairment assessments focussed only on whether the use was impaired or not, and where it was impaired. In some cases, the causes of impairment are known, but additional work will be required to more definitively identify the causes and track down the sources. The conclusions for all 14 beneficial use impairments are presented in detail in Section 4. This report includes a synthesis of the use impairments, examining them from the perspective of impacts on human use, those caused by chemical contaminants and ecological impairments. This approach presents a clearer picture of the lake environment as a whole rather than the narrow perspective of the individual assessments that focused on only one beneficial use at a time.

Of the seven BUIs considered to be human use impairments, four are considered impaired: fish and wildlife consumption restrictions; restrictions on dredging; recreational water quality impairments; and degradation of aesthetics. The five BUIs categorized as being caused by chemical contaminants are all considered to be impaired: restrictions on fish and wildlife consumption; restrictions on dredging; fish tumors and other deformities; animal deformities or reproduction problems; and benthic deformities. All of the seven BUIs addressed under ecological impairments are impaired: degradation of phytoplankton and zooplankton populations; degradation of fish populations; loss of fish habitat; degradation of wildlife populations; loss of wildlife habitat; degradation of benthos; and eutrophication or undesirable algae.

Chemicals of concern to Lake Erie were identified from the beneficial use impairment assessment reports, those listed as being persistent and bioaccumulative under the GLWQA, the U.S. Great Lakes Water Quality Guidance (GLI), the Canada-Ontario Agreement, the Binational Toxics Strategy, the Canadian Toxic Substance Management Policy, and RAPs. Due to their association with a number of beneficial use impairments across the lake, PCBs and mercury were identified as critical pollutants for priority action under the Lake Erie LaMP.

As a preliminary step to identifying sources and loadings of the above mentioned chemicals of concern to Lake Erie, all existing databases that might contain any information on the list of chemicals were examined for their utility to calculate loadings. Although the databases may be adequate for their intended purposes, this LaMP exercise concluded that available data for PCBs, organochlorine pesticides, mercury and PAHs were not suitable for describing the occurrence and distribution of contaminant concentrations or to compute contaminant loads. Nutrient data, however, do appear to be suitable for characterizing both concentrations and loads. Since existing data could not be used to calculate loads, the LaMP is pursuing using the data for source trackdown. The next steps will be to map contaminated sediment locations for the entire lake and compare this with fish tissue concentrations, proximity to populated areas and point sources, land use particularly as associated with agriculture, and concentrated industrial areas. The intent is to locate source areas for particular chemicals of concern by comparing the results illustrated on the maps.

The GLWQA requires that the LaMPs define "…the threat to human health posed by the critical pollutants…" in the lakes. It was determined during the evolution of the Great Lakes LaMP process that this meant something more than addressing the BUIs that relate to human health. Connecting human health issues to environmental conditions is a difficult problem to address. For concerns outside of the identified BUIs, the key concepts to consider are a weight of evidence approach, pathways of exposure, and bioaccumulation. The human health section presents an overall approach to Great Lakes human health, identification of data gaps and emerging issues, and any situations of particular concern to Lake Erie. This is another area where members of the Lake Erie Binational Public Forum have worked directly to raise and support additional focus on human health components.

The Lake Erie LaMP must connect and coordinate with many existing or concurrent programs to ensure that the most important needs for Lake Erie are identified, prioritized and addressed in the most effective manner. Much of the information already compiled under RAPs, the Great Lakes Fishery Commission, the Binational Toxics Strategy, the North American Waterfowl Management Plan and others has been used for problem definition and goal setting. Stronger connections with these programs must be cultivated, particularly to ensure widespread and effective implementation of management actions to protect and restore Lake Erie. The binational Lake Erie at the Millennium Plan is a collaborative network to support and coordinate research to solve the basic ecological questions relevant to the changing Lake Erie system. It will pursue the resources to implement the research needed to help define the management actions needed.

In addition to fostering close connections to the above programs, and in response to the Binational Executive Committee's LaMP resolution, ongoing and potential actions under three areas were reviewed and presented. These areas include habitat restoration, PCB reductions, and mercury reductions. The framework for developing a LaMP habitat restoration strategy is presented along with the description of 37 ongoing or recently completed habitat projects that may assist in improving or restoring habitat. Nineteen proposed habitat projects that require additional resources are also described. For PCBs and mercury, a brief history of the use of these critical pollutants and what actions are currently underway and proposed are presented.

As noted throughout the Lake Erie LaMP 2000 document, Lake Erie is constantly changing. We must always keep an eye on significant ongoing and emerging issues that may necessitate changes in management decisions for protecting and remediating the lake. For example, non-indigenous invasive species have been introduced to the lake numerous times as human settlement became increasingly intense. The ease of worldwide transport and trade has done much to accelerate the number of exotic species introduced. Most recently, zebra mussels have profoundly impacted the lake ecosystem. Many, many other species, both aquatic and terrestrial, have recently invaded or are poised to invade. Efforts must continue to prevent further invasions and to eradicate or at least control the species that have already taken hold.

Other emerging or ongoing issues of concern include climate change, long range transport of persistent contaminants, and the potential discharge and impacts of endocrine disrupting chemicals.

Much detailed information on the current state of Lake Erie is presented in the Lake Erie LaMP 2000 document. Much more is presented in the background technical documents that support the summaries presented in this report. The following list highlights the major findings and conclusions determined by the Lake Erie LaMP process to date.

1. The physical characteristics of Lake Erie have a direct bearing on how the lake ecosystem reacts to various stressors.
2. Of all the Great Lakes, Lake Erie is exposed to the greatest stress from urbanization, industrialization and agriculture.
3. As land use and lake use changed, so to did the issues of concern in Lake Erie.
4. Phosphorus continues to be an issue in Lake Erie. However, the issue has become much more complicated than just monitoring loading to the lake. Internal processing, energy transfer, zebra mussels, spotty eutrophic conditions and oligotrophic conditions are all now part of the equation. The phosphorus management issue needs to be evaluated from a total ecosystem perspective.
5. For Lake Erie, it is not a feasible approach to try to return to the pristine conditions of the pre-1700s. The level of change in the ecosystem has been extensive and, in many cases, appears irreversible.
6. The systems model developed by the Lake Erie LaMP has identified four potential ecosystem alternatives for Lake Erie to guide future management. All four represent varying levels of natural land availability.

7. Based on the LaMP modeling exercise, land use practices and nutrient loading are the primary human activities affecting the future state of the Lake Erie ecosystem. Land use practices affect habitat, influence hydrology and sediment runoff, and contribute to loadings of contaminants.
8. Of the 14 potential beneficial use impairments listed in the GLWQA, only three are not impaired in Lake Erie: tainting of fish and wildlife flavor; restrictions on drinking water; and added costs to industry or agriculture.
9. PCBs, mercury, lead, chlordane, dioxin, DDE, DDT, mirex, dieldrin, PAHs, nitrates, phosphorus, fecal coliform and E.coli, other organochlorine compounds and pesticides have all been identified as impairing beneficial use in the Lake Erie LaMP boundaries.
10. Other causes of use impairment are: habitat loss, non-indigenous invasive species (exotics) and sediment loading.
11. PCBs and mercury have been identified as Lake Erie LaMP critical pollutants for priority action.
12. Existing databases are not suitable for calculating loads for PCBs, PAH, organochlorine pesticides and mercury.
13. The Lake Erie LaMP will be taking a source trackdown approach by mapping contaminant concentrations in sediment and fish tissue, and reviewing ambient water quality data.
14. Stronger connections must be built with other ongoing programs such as RAPs, GLFC, Binational Toxics Strategy, North American Waterfowl Management Plan, Lake Erie in the Millennium Plan, and others.
15. Actions to restore and protect habitat, and reduce PCBs and mercury are priority considerations for implementation.
16. Ongoing and emerging issues must continue to be monitored. Issues of particular concern are: non-indigenous invasive species (exotics), the effects of climate change, long range transport, endocrine disrupting substances/pesticides, and the further work on the role and impacts of phosphorus management in the present day Lake Erie system.